

## **From corrosion to biology. A tour with microelectrode applications.**

A.C. Bastos

DEMaC – Department of Materials and Ceramic Engineering and CICECO – Aveiro Institute of Materials, Universidade de Aveiro, Portugal, acbastos@ua.pt

### **Abstract**

This communication gives an overview of some lines of research being conducted at the Department of Materials and Ceramic Engineering of University of Aveiro with electrochemistry in the background and microelectrode techniques as the connecting link.

The talk starts with metallic corrosion, its impact in our metals-based society and the localised nature of the phenomenon. Being corrosion an electrochemical process, electrochemical methods are well suited for its investigation. However, the traditional techniques provide the average response of the sample and miss the localised features. These can be resolved with the help of microelectrodes. A few localised electrochemical techniques are described with emphasis laid on three types of sensor that operate close to the corroding surface. One is a small vibrating probe that senses the electrical field in solution and maps the ionic currents flowing therein. The others are simply micropotentiometric and microamperometric sensors, which, long before the ascension of the scanning electrochemical microscope, were already being used to sense the chemical species involved in electrophysiological processes, in living tissues or inside biological cells. In corrosion these techniques provide information about the localisation of anodes and cathodes in the active electrode, their rates and also the local concentration of important species like dissolved O<sub>2</sub>, pH, metal cations from the corroding surface and ions from the testing medium. General information is given on how these microelectrodes are constructed, how they work, their capabilities and limitations, together with selected examples in corrosion research.

These techniques are also being used to probe the self-healing properties of protective coatings which has become a hot topic in recent years. Results of self-healing materials for corrosion protection developed by the group, their synthesis, their characterisation, their modes of action and the corrosion testing are presented. A new area for the group is the application of the microelectrodes to analyse the degradation of biomaterials, in collaboration with research groups from the Materials department.

The talk ends with illustrative examples of these microelectrodes in biology, which is the area where they were developed and used for the first time. Hopefully, this sort of studies will be performed in Aveiro as well, in collaboration with the Biology department.